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Appendix D

Structures Analysis Technical Memorandum

Memo

To: Ms. Samira Shalan, PE, City Engineer

From: Erick Cuervo, P.E.

Date: March 28, 2022

Re: **Plantation Midtown Bridge PD&E Study – Structures Analysis Memo Report**

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1. BRIDGES AND STRUCTURES

The existing bulkhead wall extending along the South approach of SR-84 is comprised of steel sheet piles and a concrete cap. The bulkhead concrete cap is uniform in width along its length, with the exception of Light Pole Pilaster locations, where the width is adjusted accordingly. Note that there are no light poles located within the proposed site. Above and behind the bulkhead's cap, is a concrete traffic railing extending along SR-84.

2. BRIDGE ANALYSIS

A. Specifications

The design of the structural elements for this project will be in full compliance with the Florida Department of Transportation standard practices and procedures. The design will comply with the most recent editions of the following design specifications:

- American Association of State Highway and Transportation Officials, AASHTO LRFD Bridge Design Specifications, 8th Edition, 2017
- Florida Department of Transportation, Structures Manual, January 2022
- Florida Department of Transportation, Standard Specifications for Road and Bridge Construction 2022
- Florida Department of Transportation, 2022 FDOT Design Manual

FDOT Specifications will take precedence over the AASHTO Specifications wherever they are at variance.

B. Loadings

All design loadings shall be in accordance with the Florida Department of Transportation's Structures Design Guidelines and the AASHTO Specifications.

C. Vessel Collision

According to the Florida Department of Transportation's Structures Design Guidelines and the AASHTO Specifications, the design of all bridges over navigable waters must include consideration for possible Vessel Collision. These specifications do not apply to this bridge since the North New River Canal is not a navigable waterway.

D. Geometric Controls

The proposed bridge will have a low member Elevation of +9.25, satisfying the required minimum vertical clearances of 6 feet over the Optimum Water Surface (El. +2.0) and 2 feet over the Design Water Surface (El. +4.00).

In comparison, the span lengths of the proposed Plantation bridge will be longer than the adjacent existing Bridge No.'s 860165 and 860158. The PD&E proposed a 180'-0" bridge length necessary to span the North New River canal. Based on site survey, the bottom of the canal is as deep as (El. -4.8) with a width of approximately 80 feet.

Fill and slope protection is being proposed to provide a consistent and uniform canal embankment, which will minimize potential debris accumulation and erosion, thus reducing maintenance requirements. Although the existing canal banks are in some locations up to 1V:1.6H, the proposed fill cannot be steeper than 1V:2H. Even though the slopes may vary, the proposed correction to the bank will provide a stable canal embankment section.

E. Aesthetics

The bridge aesthetics shall conform to Aesthetic Level Three.

F. Environmental Classifications

Geotechnical investigation is in process. Geotechnical Consultant will determine the environmental classification.

G. Construction and Maintenance Considerations

Bridge structure alternatives were evaluated for the reasonable and practical use of equipment, fabrication, and construction techniques, as well as for proper material handling and transportation, safe maintenance of traffic, and appropriate construction sequence. Access to project location for transportation of construction materials and equipment is possible by local roads. The design allows for continued access to all parts of the structure after construction is completed. This accessibility is required to provide a proper environment for bridge inspection and maintenance.

3. Design Alternatives

A. Geometric Alternatives

The proposed bridge lengths were determined based on the existing North New River Canal cross-section. Typically, a 1V:2H slope will be constructed from the top of the canal banks at the North approach to 1 foot above the bottom of the end bent caps, while providing a 3-foot minimum berm in front of the abutments. At the location of the niche in the canal bank, the 1V:2H slope will be constructed from the point where the canal bank becomes flatter than 1V:2H.

B. Precast Bridge Options

The use of either partial or full precast bridge alternatives with the specific purpose of accelerating bridge construction and reducing user impact were investigated and determined not to be a viable option. A precast bridge or components do not add significant cost and/or time savings due to the short length of the bridge. Moreover, an accelerated schedule is not a necessity since the traffic along SR-84 and SW 17th Street will still be maintained while construction is ongoing.

C. Substructure Alternatives

Pile bent foundation systems have been successfully used in bridge projects in the area and would be suitable for the area soil conditions.

The proposed bridge's south approach end Bent located along SR-84 will be installed in front (canal side) of the existing bulkhead comprised of sheet piling and a concrete cap.

The existing bulkhead will continue to act as a retaining wall, with only some alterations made. The bulkhead's sheet piling and cap, along the width of the proposed bridge, would be lowered so that the top of the concrete cap is in line with the bottom of the Bridge's end Cap. This would allow access to these components for routine inspections.

The south approach end bent for the proposed bridge will be comprised of driven pre-stressed concrete piles supporting a cast-in-place concrete cap positioned along the north face of the existing bulkhead. This substructure configuration prevents any portion of the structure along the north end from extending into the channel.

D. Superstructure Alternatives

The bridge's superstructure alternatives considered were cast in place slab bridge and prestressed concrete slab units. Steel beams and I-Beams were not considered due to the low vertical clearance. According to the Structures Design Guidelines and Structures Design Bulletin C12-08, a minimum vertical clearance of 12 ft is required for steel girders when the superstructure environment is classified as slightly aggressive Environment. The primary factors in determining the superstructure selection were minimizing costs while achieving SFWMD's vertical clearance criteria for the North New River Canal.

4. Proposed Structure

A. Recommendations

This Bridge Development Report recommends that the proposed bridge typical section will consist of a 66.16ft wide bridge composed of: 1.5ft Single Slope Traffic Railing, 6ft Outside Shoulder, one Southbound 11ft Travel Lane, 1.33ft Inside Shoulder, 15.5ft Median, 1.33ft Inside Shoulder, two Northbound 11ft Travel Lanes, 6ft Outside Shoulder and a 1.5ft Single Slope Traffic Railing.

The bridge will be 180'-0" long. The bridge will utilize an 18" thick concrete deck. The simply supported spans will rest on 18" precast prestressed concrete piles with cast-in-place concrete caps. The minimum vertical clearance from the low member is 5.25 feet to the Design Water Surface and 7.25 feet to the Optimum Water Surface.